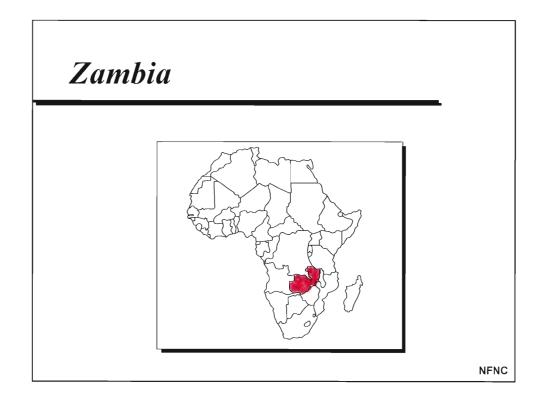
Fighting Malnutrition in Zambia: A National Plan of Action



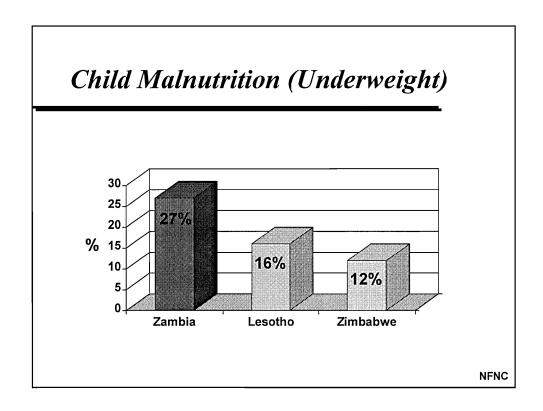
Academy for Educational Development, Inc. 1875 Connecticut Avenue, N.W., Washington, DC 20009-1202

Fighting Malnutrition in Zambia: A National Plan of Action

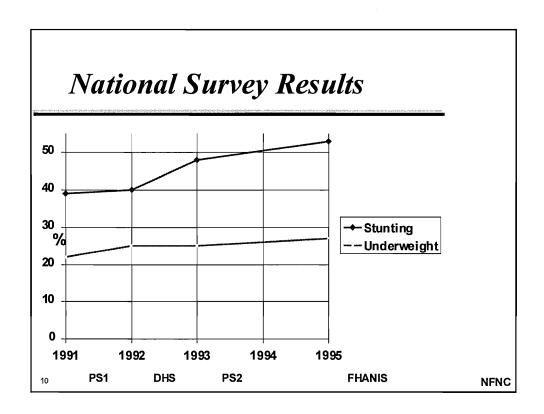
A *Profiles* Application for Nutrition Policy Analysis and Advocacy



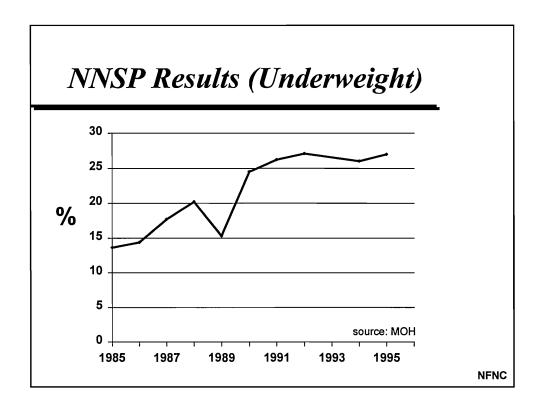
Zambia's abundant natural resources, relative political stability and strong economic policies make it well prepared to enter the next century and succeed in the global economy. But this cannot happen without adequate human resources—without a healthy, strong, and intellectually competent future workforce.



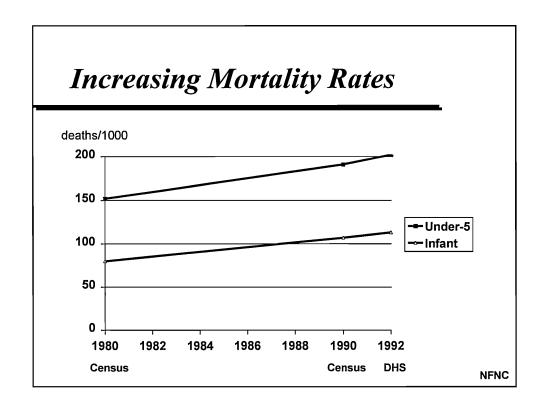
Recent studies on child malnutrition indicate that 27% of Zambian children are malnourished, as compared to 16% in Lesotho and 12% in Zimbabwe. Given this level of child malnutrition, there is a real danger that future economic development will be slowed by a workforce that lacks the stamina to perform to its full physical and intellectual potential.



In recent years, malnutrition in Zambia has become more serious. Large national surveys indicate that the rates of both underweight and stunting have been increasing.



NNSP data suggest that this trend has been continuing for some time, at least since the mid-1980's.



This increase in child malnutrition is partly responsible for an alarming growth in infant and child mortality since 1980 and a corresponding decrease in life expectancy over the same period. This trend must be halted and reversed.

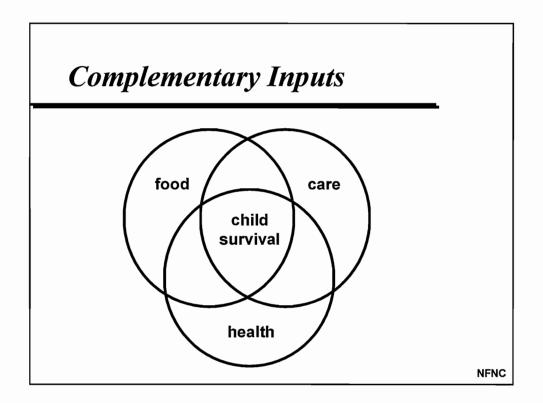
Outline of Presentation

- Nutrition problems
- Consequences
- Solutions

Reverse increase in child mortality Economic benefits

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In this presentation, we will examine in greater detail nutrition problems in Zambia and the enormous consequences that they will have if they are not addressed. We will show how solutions to these problems can reverse the increase in child mortality. These solutions make sound economic sense, and we will see how today's investments in nutrition interventions can save billions of kwacha now and in the future.



Adequate nutrition requires three main complementary inputs. In this presentation, we focus on caring behaviors such as exclusive breastfeeding and appropriate complementary feeding in infancy, the time of greatest nutritional vulnerability. The other solutions that enable these direct nutritional inputs to succeed include the protection of child health and the provision of adequate household food security. This diagram shows how food, health and care are all necessary to ensure adequate nutrition for child survival.

Nutrition Problems

- protein and energy
- iodine
- iron
- vitamin A

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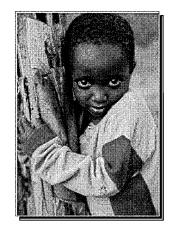
Hidden Nutritional Problems

The major nutrition problems affecting Zambia are lack of sufficient protein and energy, iodine deficiency, iron deficiency, and vitamin A deficiency.

Each of these nutrient deficiencies has profound consequences for infants, children, and adults. They significantly increase child mortality, greatly reduce mental capacity, and deprive workers of their productivity.

Hidden Malnutrition

No outward signs
Victims not aware



UNICEF/94-1173 Pirozzi

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To a large extent, these nutrition deficiencies are hidden problems. Millions of Zambians are deficient in iodine, iron, or vitamin A, but show no outward signs of gross deficiency, such as cretinism, anemia or blindness. The victims themselves may not know anything is wrong, and thus continue the dietary patterns and infant feeding practices that perpetuate the problem. Even mild forms of deficiency have consequences. For example, even though the protein-energy malnutrition of most Zambian children is only mild or moderate, many of these mildly stunted and underweight children will die prematurely, and those who survive will be less productive as adults.

Consequences

Child deaths

Decreased mental capacity

Lower worker productivity

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Although malnutrition inflicts many different kinds of damage on individuals and society, this presentation will focus on only three consequences: child deaths, decreased mental capacity, and lower worker productivity.

Zambia's Year 2000 Goals

- Reduce stunting and underweight 25%
- Eliminate Vitamin A and iodine deficiency
- Reduce Iron deficiency by 1/3
- · 90% exclusively breastfed

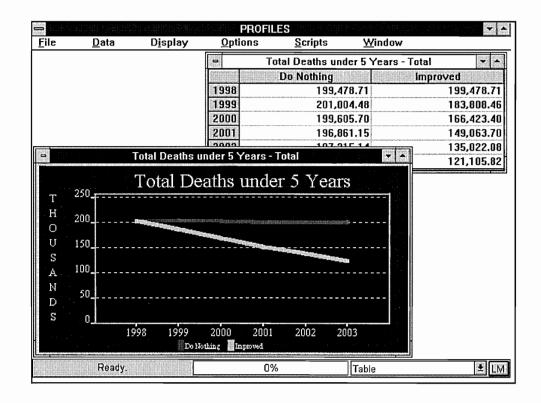
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Goals

Experience in Zambia and around the world has shown that there is a lot that can be done *right now* to improve the nutritional status of vulnerable groups. Later we will provide some information about the proposed National Plan of Action for Nutrition, but first we will outline the goals we expect to realize. Some of these are the national nutrition goals that Zambia has established for the year 2000, including: reducing the prevalence of stunting and underweight in children under 5 by 25% from the 1990 level, eliminating vitamin A deficiency in the population, eliminating iodine deficiency disorders, and reducing iron deficiency anemia by a third.

We further hope that 90% of infants will be exclusively breastfed through the first six months of life.

Significant progress has already been made towards these goals through the iodization of the national salt supply, mass distribution of vitamin A capsules, and certification of half of Zambia's hospitals as "baby friendly".



Consequences of Malnutrition and Potential Benefits of Action

To estimate the potential economic benefits of the program in Zambia, we used a computer-based simulation model called *Profiles*. This model makes projections of changes in population and nutritional status and estimates the consequences for up to thirty years into the future.

PROFILES Assumptions

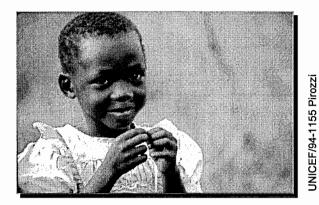
- Six-year period: 1996-2001
- UN medium population projection
- National surveys
- Scientific literature
- Assumptions can be changed

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Like all projections, these estimates are based on assumptions. The projections developed for this purpose cover the six-year period from 1996 through 2001, the period of the current government's new mandate.

The assumptions for patterns of population, fertility, and mortality come from the UN medium population projection; the nutrition data come from national and other surveys; and the models and coefficients that link nutrition to mortality, intellectual development, and productivity are based on the scientific literature. An important feature of the *Profiles* software is that the assumptions can be easily changed at any time and new projections computed.

Child Mortality



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Let's look at three of the main nutrition-related problems facing the country, beginning with child mortality.

Nutritional Causes of Child Mortality

Before 6 months:

Giving liquids and foods other than breastmilk

After 6 months:

Inadequate complementary feeding Vitamin A deficiency

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Consequences: Increased Mortality

The main nutritional causes of child deaths include feeding infants liquids and foods other than breastmilk in the first six months, then after six months, inadequate complementary feeding and vitamin A deficiency. We divide the problems by age in this way because the nutritional problems and solutions are distinct.

Before 6 Months

Infants need nothing but breastmilk.

Other foods carry infections.

These infections kill an estimated 4,000 infants.

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We now know that in most cases infants need nothing but breastmilk before they are six months old. The danger of other liquids and foods is that they carry infections. These infections kill an estimated 4,000 Zambian infants each year before the age of six months.

Non-Exclusive Breastfeeding

Other effects:

- · growth faltering
- underweight and stunting
- weakened immunity

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Infants who survive the first six months suffer other effects of non-exclusive breastfeeding: growth faltering (leading to underweight and stunting) and weakened immunity.

After 6 months

Consequences of poor complementary feeding practices:

- Growth faltering
- · Impaired immunity
- Sickness
- Death

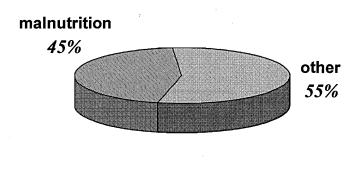
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Unfortunately, after the child is six months old, problems persist. Breastmilk is a perfect food but it is no longer enough. The infant now needs to be fed complementary foods rich in energy and nutrients at frequent intervals.

Instead, the usual practice is to occasionally feed the infant a thin starchy porridge. Lacking energy, protein and other essential nutrients, the infant's growth further falters.

Even more seriously, protein-energy malnutrition impairs a child's immune system, contributing to sickness and increasing the risk of death. This risk depends on how severe the problem is, but even mildly underweight children are more than twice as likely to die as normal children.

Causes of Child Mortality

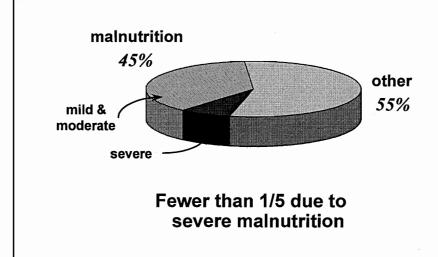


About 45% of child deaths are due to malnutrition.

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We estimate that in Zambia about 45% of all child deaths beyond early infancy are due to protein-energy malnutrition, making this the single greatest cause of child mortality.



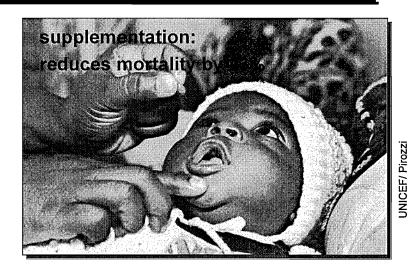


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It is important to realize that fewer than one in five of these nutrition related deaths are due to severe malnutrition.

This means that significant reductions in mortality can only be achieved by preventing mild and moderate malnutrition. Rehabilitation of severe cases is important but our primary strategy must be preventive.

Vitamin A Deficiency



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Another important nutritional cause of child mortality in Zambia is vitamin A deficiency. We used to think that vitamin A deficiency was a problem mainly for eye health and vision. Only in the last decade have scientists discovered and quantified the effect of mild deficiency on immunity. Supplementation in affected communities reduces child mortality by an average of 23%.

Vitamin A Deficiency

prevalence of mild deficiency: 20%

result: 7,000 child deaths per year

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Although there are no precise estimates of the prevalence of mild deficiency among children in Zambia, it is estimated at 20% and results in over 7 thousand child deaths every year.

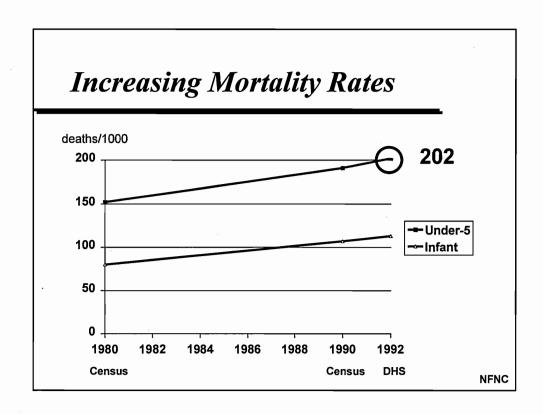
Child Mortality

Other Nutritional Causes:

- Low birth weight
- Maternal iron and iodine deficiency

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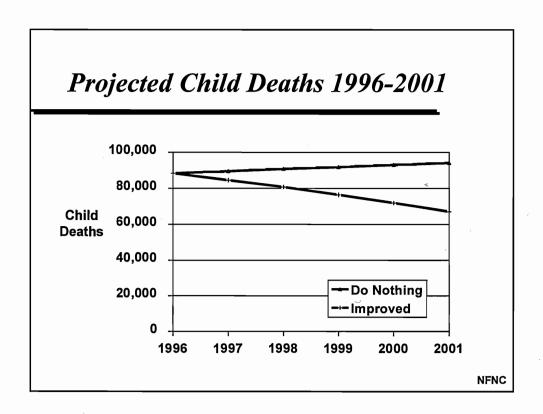
Other causes of mortality that the national plan of action will address include low birth weight and maternal iron and iodine deficiency.



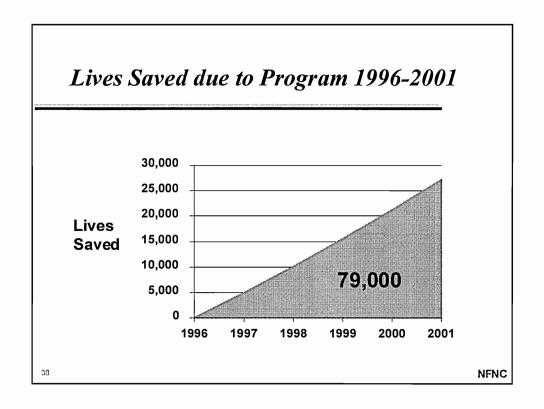
Benefit: Mortality Reduction

We have already seen that infant and child mortality are increasing. Our most recent data indicate that 202 out of every 1,000 children die before reaching the age of five. This is an extremely high child mortality rate, even by developing country standards.

But let's look at what would happen if the nutrition program we have described is implemented and achieves its goals gradually over the sixyear period.



According to the UN projection, a staggering 548,000 preschool children will die in Zambia from 1996 to 2001. This is the status quo or "do nothing" estimate.



But if, in the "improved" situation, underweight in Zambia were reduced 25% from the 1990 level by the year 2001, if vitamin A deficiency were eradicated, and if 90% of mothers exclusively breastfed to 6 months, then over the six years 79,000 lives would be saved.



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Iodine Deficiency and Mental Capacity

Let's now look at the effect that iodine deficiency has on brain development and intelligence. This picture shows one of the most visible signs of iodine deficiency—goiter—caused by the overgrowth of the thyroid gland in the neck.

The 1993 national survey found that 32% of school children had goiter. Typically, the rate is somewhat higher in women, especially in pregnant women. This is particularly alarming because iodine deficiency during pregnancy causes damage to the nervous system of the unborn fetus, later resulting in the birth of cretins and other mentally impaired children.

Iodine Deficient Populations

Intelligence reduced by 13.5 IQ points

source: 18 studies (other countries)

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According to the results of a recent study combining information from eighteen different studies around the world, the average intelligence of children in iodine-deficient areas is reduced by about 13.5 IQ points. Thus, in addition to the highly visible problems of cretinism and severe impairment, there is widespread but hidden brain damage, resulting in very significant IQ reductions in the general population.

Iodine Deficient Populations

Intelligen anent. aced
by Permanent. aced

source: 18 studies (other countries)

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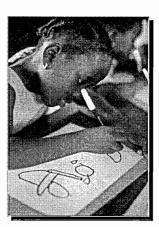
Moreover, the damage appears to be permanent. The only solution is to prevent the mother from becoming iodine deficient before pregnancy.

- 3% cretins
- 10% severely impaired
- 87% mildly impaired

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Another study, using data from seven Asian countries, indicates that a little more than 3% of all babies born to iodine-deficient mothers are cretins and another 10% are severely mentally impaired. But this is only the most severe and visible part of the problem. The remaining 87% of infants are also thought to suffer some degree of brain damage during development, resulting in mild impairment and reduced IQ.

each year: 142,000 with brain damage



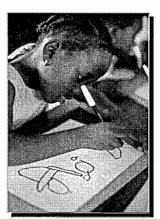
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Even if we use the total goiter rate of 32% rather than the higher rate for pregnant women, we find that of the approximately 443,000 Zambian children to be born in 1996, there will be about 142,000 with some form of brain damage due to iodine deficiency. This probably underestimates the actual extent of damage because recent research suggests that many mothers without goiter have subclinical iodine deficiency affecting brain development.

Such damage increases the burden on families, schools, and other institutions, seriously reducing the country's ability to develop socially and economically.

intelligence education productivity



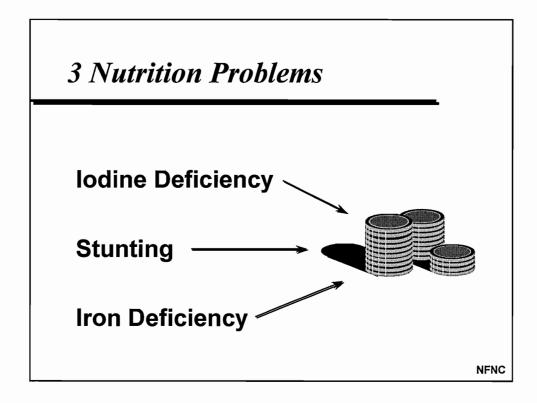
NICEF/C-56-19/Murray

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Benefits: Mental Capacity

Elimination of iodine deficiency would avoid the massive dulling of intelligence that is occurring in many parts of this country. Over the six years of the program, an estimated 4.5 million newborn infants would be saved from the effects of brain damage. This would result in huge improvements in the efficiency and cost-effectiveness of education, and the increase in intellectual ability would also have an enormous impact on the economic productivity of these children as adults.

Next, we will discuss the value of this productivity increase.



Productivity

We will now look at three nutrition problems that affect the economic productivity of the workforce: mental impairment due to iodine deficiency, childhood stunting due to protein-energy malnutrition, and iron deficiency anemia in women. These are all significant health problems in and of themselves. But in addition, they have a profound impact on a key element of Zambia's economy—worker productivity. Let's explore this issue in greater detail, starting with iodine deficiency and productivity.

Iodine Deficiency and Productivity



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We must remember that the mental impairment caused by iodine deficiency is permanent. Children who have reduced mental capacity have trouble learning in school and grow up to be adults who also are less productive in the work force. Let's take a moment to examine how the current level of iodine deficiency will affect worker productivity and the value of economic output.

Assumptions

- total goiter rate 32%
- 3% cretins
- 10% severely impaired
- 87% mildly impaired

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For this projection, we assume, as before, a total goiter rate of 32%, that 3% of the births to women with goiter are cretins, that 10% are severely mentally impaired, and that the remaining 87% are mildly impaired.

Assumptions...

- cretins not productive at all
- severely impaired 25% less productive
- mildly impaired 5% less productive
- discount rate 3%
- · adjusted for mortality and unemployment

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We assume that cretins are not productive at all as adults, that the severely impaired are 25% less productive than normal adults and the mildly impaired are 5% less productive. Because future production is worth less than current production we discount future production at a rate of 3% per year, adjusting for mortality and unemployment.

Present Value of Lost Wages

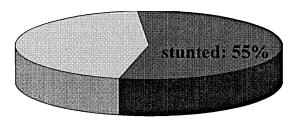
> \$21 million/year \$135 million over six years

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The cretins and mentally impaired infants born in 1996 would have discounted lifetime productivity losses of over 21 million dollars. During the six years of the program, the cumulative losses would be about 135 million dollars.



Stunting at age 2



Source: FHANIS, 1995

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Let's consider the effects of stunting on productivity. Stunting, or failure to achieve normal height, occurs when children do not get enough food during the first years of life. We have already seen that malnutrition also contributes to illness, which makes the stunting worse. In 1995, 55% of all Zambian two-year-olds were moderately or severely stunted. Stunted children grow up to become stunted adults.

Consequence of Stunting

Reduces productivity



JNICEF/91-029 J Schytte

1% decrease in height = 1.4% decrease in productivity

Source: Haddad & Bouis, 1990

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One of the most significant consequences of adult stunting is reduced physical capacity and economic productivity. Even mild stunting has significant effects. Research conducted in the Philippines shows that the productivity of physical labor declines by 1.4% for every 1% that adult height is reduced.

Assumptions

- productivity varies by stunting degree
- · two thirds of work is affected
- 3% discount rate
- normal patterns of mortality
- 63% labor force participation rate
- 74% in agriculture
- 86% employed
- agricultural wage \$336

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Let's use an example to show the economic consequences of this reduced productivity.

In the calculations that follow, we have made a number of assumptions. We assume, first, that productivity declines in direct proportion to the severity of childhood stunting at age two. Second, we assume that only two thirds of the work performed in the Zambian agricultural economy is affected by stunting. Third, as before, future production is discounted at an annual rate of 3% per year. Fourth, normal patterns of mortality apply. Fifth, we assume an average labor force participation rate of 63%, that 74% of the population is working in agriculture, and that 86% of the agricultural labor force is actually employed. Finally, we assume that the typical agricultural worker earns 336 dollars per year.

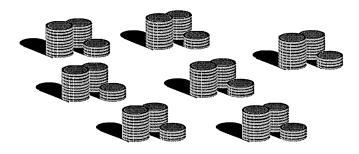
Per Chi Estimat	_	luc	tivity	
	Annual Productivity (\$)		Years of Labor	Lifetime Productivity (\$)
normal	336	X	50	= 16,800
stunted	314	х	50	= 15,700
				\$ 1,100
				NF

For our example, we take two Zambian children who will be two years old in 1996. One of these children is well-nourished and of normal height; the other is stunted. The normal child will earn, on average, 336 dollars per year as an adult, assuming he works as an agricultural laborer. His earnings over his working lifetime, assumed to be 50 years, will be about 16800 dollars.

By comparison, a stunted child will earn only 314 dollars per year, and the value of his lifetime earnings would therefore amount to only 15700 dollars. The difference between the two does not seem that large—1100 dollars.

Economic Losses Due to Stunting 1996

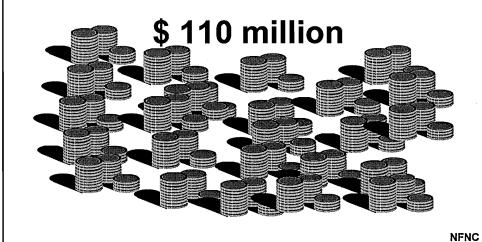
\$ 17.5 million



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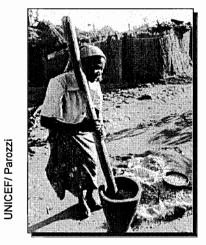
However, when this difference is multiplied by all the stunted two-year old children in 1996, adjusted for mortality and unemployment and discounted back to the present, we find that the country will lose 17.5 million dollars in potential future production due to the stunting occurring in 1996 alone.

Cumulative Losses 1996-2001



Over the six years of the proposed program, assuming that current levels of stunting remain unchanged, Zambia will lose 110 million dollars as the direct result of the poor nutrition of these children.

Iron Deficiency Anemia



34% of women

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Iron Deficiency and the Productivity of Agricultural Workers

In Zambia, iron deficiency affects all ages and both sexes, but is most common in the young and in women of childbearing age. By international standards, rates of iron deficiency anemia are thought to be high in Zambia. Although no comprehensive national surveys have been done, rough estimates based on smaller surveys suggest that 34% of women are anemic. Let's examine how this serious nutrient deficiency affects productivity in the agricultural sector.

Assumptions

- annual wage \$336
- 59% labor force participation rate
- 83% in agriculture
- 79% employed
- 1% reduction in productivity for each 1% drop in blood iron

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In making these calculations, we assume an annual wage of \$336 dollars, as before; an average female labor force participation rate of 59%; that 83% of the female population is working in agriculture; that 79% of the female agricultural labor force is actually employed; and that there is a 1% reduction in productivity for each 1% drop in blood iron.

Losses due to anemia

Female labor force:



1996:

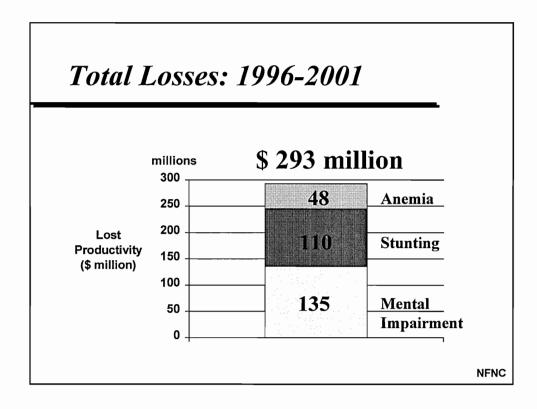
\$ 7 million

1996-2001: \$ 48 million

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Using these assumptions, we project a total loss of over 7 million dollars in 1996 alone due to iron deficiency anemia in just the female labor force. Over the six years of the program, cumulative losses in agricultural productivity would be 48 million dollars.

Unlike the lost future income of stunted children, which is not realized for ten to fifteen years, the economic losses from anemia are occurring right now.



Summary of Consequences

Thus the total cost of malnutrition to worker productivity, due only to the causes and effects considered here, is:

- 135 million due to mental impairment,
- 110 million due to stunting, and
- 48 million due to iron deficiency anemia.

This is a total loss of 293 million dollars—just over the six years of the program and just for the problems we have examined here.

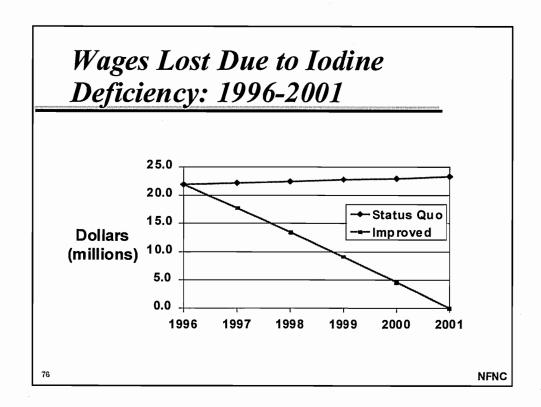
Productivity Gains from Reducing

- Goiter
- Stunting
- Iron deficiency anemia

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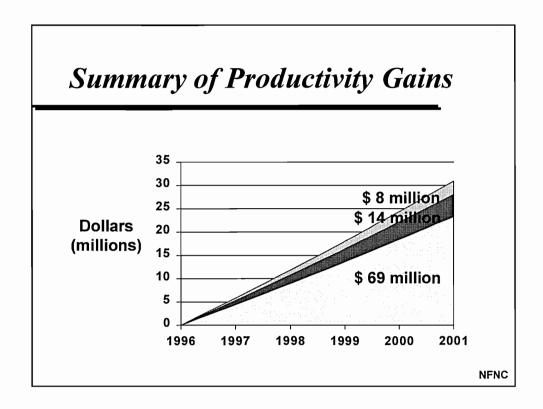
Benefit: Productivity Increases

Now let's look at the potential productivity gains that can be realized by reducing goiter, stunting, and iron deficiency anemia.

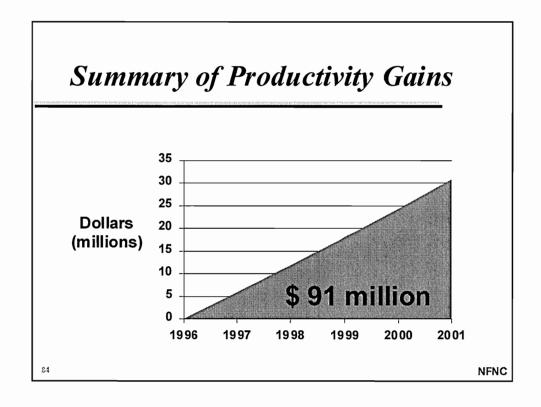


Productivity Increases Due to Reduced Iodine Deficiency

We assume that the program will eliminate iodine deficiency in pregnancy by 2001, thus eliminating the mental impairment and cretinism due to iodine deficiency and ending the associated productivity losses. So, rather than remaining stable at about 22 million dollars per year, the discounted value of lost lifetime wages for these children will fall to zero by the year 2001.



Over the six years, the difference between the status quo and improved scenarios, or the increase in discounted future productivity due to elimination of iodine deficiency, would be a cumulative value of 69 million dollars.



Similarly, the cumulative total of productivity increases due to reduced stunting over six years is estimated at 14 million dollars, and for reduced iron deficiency in pregnant and lactating women is estimated at 8 million dollars.

This is a total of 91 million dollars in present value gained over six years.

Solutions

Approaches that work:

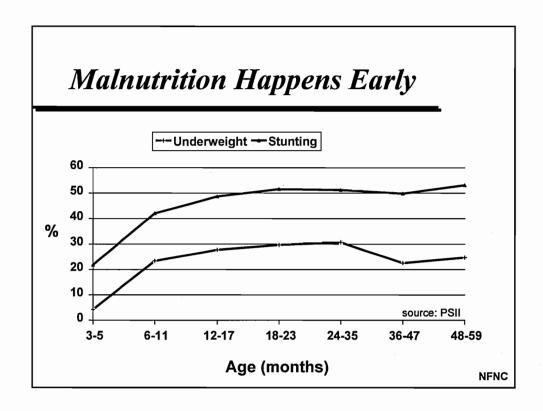
- Involve whole communities
- Target neediest
- Different strategies at different ages

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Solutions

Realizing these gains, however, will require vigorous efforts to reduce malnutrition. Project experiences in Zambia, Tanzania, and elsewhere suggest what approaches work best.

The most successful programs are those that involve whole communities in the design and implementation of the intervention, target the needlest individuals in the population, and adopt different strategies at different ages.



For example, there is a particular need to focus on infancy because it is when the greatest nutritional problems occur. As the Priority Survey II data show in this graph, both stunting and underweight increase rapidly during the first year of life. By the beginning of the second year, the damage is done. After this there is little or no recovery. This means that solutions need to focus on the first year of life.

Solutions:

- Growth monitoring and promotion of:
 - optimal breastfeeding
 - appropriate infant feeding practices
- Iron and vitamin A supplements
- Promote consumption of iodated salt

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Specifically, the proposed nutrition program would promote better growth through optimal breastfeeding and appropriate infant feeding practices; provide iron and vitamin A supplements to selected groups; and develop a national communications strategy to promote the consumption of iodized salt.

Other Approaches

Improve:

Household food security

Maternal nutrition

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Other approaches that provide the conditions under which these strategies are most likely to succeed include the protection and improvement of:

- household food security (through income generation, drought relief, increased production of nutritious crop varieties, promotion of home gardens, etc.);
- maternal nutritional status (through labor saving devices, prenatal care, nutritional support for the girl child and adolescent, etc.); and
- child health (through immunization, safe water supplies, vector control, integrated case management, etc.).

Cost Assumptions:

- linear scale up in costs over six years
- 100% coverage by project year 6

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Costs Compared to Benefits

The costs of implementing this program are considerable, but in this analysis we will show that even if we count only the economic productivity benefits, this project will pay for itself. In making our cost calculation we assume that the project is scaled up in linear increments over the six year period and that 100% coverage of the eligible is achieved by the sixth year.

Unit Costs

Project Component

Salt fortification
I capsule distribution
Breastfeeding Promotion
Intensive Education
Iron Supplementation

Annual Unit Costs

\$0.05 per capita \$0.50 per mother \$2.50 per infant \$10.00 per infant \$3.75 per pregnancy

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The unit costs of the project components, estimated from the literature, are shown in this table.

Unit Costs

Project Component

Salt fortification
I capsule distribution
Breastfeeding Promotion

Intensive Education ←

Iron Supplementation

Init Costs

er capita per mother

.50 per infant

<u>\$10.00</u> per infant

\$3.75 per pregnancy

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Targeting the more expensive and intensive components of the program to will reduce over all costs and will maximize benefits.

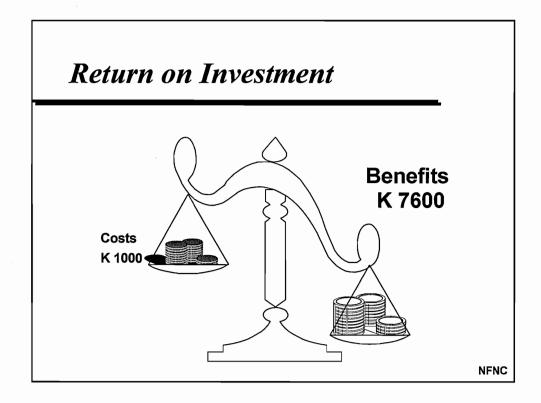
Benefit: Cost Ratios

<u>Disorder</u>	<u>Benefit</u>	<u>Cost</u>	<u>B:C</u>
IDD	68.7	3.0	22.8
PEM	14.0	4.9	2.9
ANEMIA	8.3	4.1	2.0
Total	91	12	7.6

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The six-year cumulative benefits and costs of each intervention component with an impact on economic productivity are summarized in this table.

Compared to the 7600 kwacha (or 91 million dollar) estimated six-year cumulative benefits generated by the program, the 1000 kwacha (or 12 million dollar) cost is relatively small, making this an investment opportunity with a benefit-to-cost ratio of 7.6.



Every thousand kwacha invested will generate almost 8 thousand dollars just in economic productivity gains. Note that even when the program is desegregated, each component is cost-effective.

Given the conservative nature of many of our assumptions and the omission of many benefits, this must be considered an underestimate of the true value of this investment.

- benefits accumulating beyond the project period should be added
- cost of existing programs should be subtracted

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Two points in particular need to be emphasized. First, even in the absence of any additional investment, the benefits will continue to accumulate beyond the project period as the improved behaviors continue to maintain reduced levels of malnutrition. Second, the calculations assume that the program costs are met entirely from new funding.

In fact, since these efforts are intended to revamp or improve many current programs, the cost of these existing programs should be considered savings and subtracted from the cost estimates presented.

If these points could be quantified and included in this analysis, the benefit-cost ratios presented would look even more favorable.

Additional Economic and Social Benefits:

- 79,000 lives saved
- higher IQs for 4.5 million newborn infants
- fewer school repeaters
- reduced education expenditure
- · lower rates of disease
- reduced health expenditure
- · improved quality of life

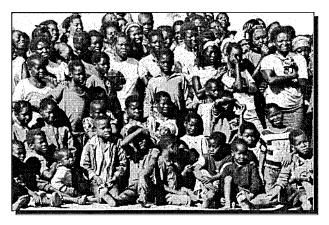
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Summary

Perhaps more importantly, in addition to the 54 million dollar increase in worker productivity, this project's benefits will include 79,000 lives saved and higher IQs for 4.5 million newborn infants.

There would be also be fewer school repeaters, resulting in reduced educational expense, and healthier children with less disease, resulting in reduced health expenditures, all leading to improved quality of life for millions of Zambians.

Zambia



UNICEF/ Piro:

NFNC

We believe the evidence presented here shows that Zambia is seriously under-investing in nutrition, resulting in large losses in economic productivity, massive numbers of child deaths, and a tragic dulling of the nation's collective mental capacity.

We have shown that even though the comprehensive nutrition program needed to change this situation would require a bold new investment strategy, this investment would reap economic and social benefits far outweighing the costs. In addition to halting and reversing recent increases in child mortality, there would be benefits to education, agriculture, industry and the economic future of the country as a whole.

If Zambia is going to develop economically and socially—if its people are going to compete in the global economy—then they must optimize their physical and intellectual growth through adequate nutrition. Zambia cannot afford to allow its most precious resource—its children—to grow up handicapped by feeble minds and bodies. The nutritional knowledge and resources needed to prevent this tragedy are readily available, and our investment in better nutrition will more than pay for itself.

Credits

The National Food and Nutrition Commission

Food, Health and Nutrition Information System

The Zambian Child Health Project

The Central Statistical Office

USAID

The Academy for Educational Development